CIRCULAR KNITTING MACHINE

FIELD OF THE INVENTION

The present invention relates to a circular knitting machine and particularly to a circular knitting machine that has sinkers mounted in an inclined manner to position yarn laps and avoid hitting yarn feeding plates when moving in an inclined manner in sinker troughs.

BACKGROUND OF THE INVENTION

Conventional circular knitting machines generally include sinkers driven by a cam. The cam has a driving path to move the sinkers to and fro to perform knitting operation.

The sinker is engaged with a preset driving path as shown in FIG. 1. During knitting operation, the lug 62 of the sinker 61 is engaged with the driving path 64 of the cam 63 so that the sinker 61 is moved according to the driving path 64 to perform knitting operation. The cam 63 is mounted horizontally on the machine deck. The sinker 61 also is mounted horizontally.

The sinker 61 is located on a sinker drum 60 which rotates at high speed during knitting operation, and the sinker 61 is driven by the driving path 64 to move reciprocally to and fro rapidly. When the sinker drum 60 rotates at high speed, the sinker 61 is moved outwards at a great centrifugal force. Hence the lug 62 of the sinker 61 does not move smoothly in the driving path 64.

To remedy the foregoing problems, Applicant has proposed an improved design that includes a sinker drum with a slant surface so that the cams and sinkers are mounted at an inclined angle against the horizontal surface. The sinkers may be moved in an inclined manner in the sinker troughs of the sinker drum thereby may be driven by the cams more smoothly.

Although the slant installation set forth above can reduce the centrifugal force of the sinker that hits the cam and increase the service life of the sinker and the cam, it creates other problems, notably: first, with the sinker directly mounted on the sinker drum in an inclined manner, the surface for holding formed yarn laps on its throat portion also is inclined. As a result, the formed yarn laps tend to slip downwards and stretch the yarn coupled on the needle. Second, with the sinker inclined, the movement of the sinker in the sinker trough also is inclined. As a result, the sinker is prone to hit the yarn feeding plate. The circular knitting machine could become inoperable. The present invention aims to improve these problems.

SUMMARY OF THE INVENTION

The object of the invention is to provide a circular knitting machine that has yarn feeding plates with a dodging edge and a slant surface formed on each of them to dodge the sinker that is moved in an inclined manner in the sinker drum, and

the sinker has a throat section which has one side extended to form an inclined first end surface so that the nose section of the sinker can hold the yarn laps at a higher horizontal spot without slipping even though the sinker is moved in an inclined manner in the sinker drum.

The foregoing, as well as additional objects, features and advantages of the invention will be more readily apparent from the following detailed description, which proceeds with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of conventional cams and sinkers mounted in a horizontal manner.

FIG. 2 is a plan view of a sinker of the invention.

FIG. 3 is a schematic view of a cam and a sinker of the invention mounted in an inclined manner.

FIGS. 4A through 4G are schematic views of the invention in knitting operations.

FIG. 5 is a schematic view of the invention showing the inclined installation without generating interference with the yarn feeding plate.

FIG. 6 is a front view of the yarn feeding plate of the invention.

FIG. 7 is a side view of the yarn feeding plate of the invention.

FIG. 8 is a time sequence chart of the sinker moving to and fro according to the invention.

FIGS. 9A, 9B and 9C are movement relationships between the sinker and yarn feeding plate.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Please referring to FIG. 3, a cam 20 is fastened to a slant surface of a saddle plate (not shown in the drawing) mounted on a machine deck of a circular knitting machine and forms an inclined angle α against the horizontal surface. The cam 20 has a driving path 22 to allow a lug 21 of a sinker 10 to slide therein. The sinker 10 also is mounted in a slant manner to match the cam 20.

Referring to FIGS. 2 and 3, the sinker 10 according to the invention includes a belly section 11, a nose section 12 and a throat section 13. The throat section 13 has one end forming a first end surface 131. The belly section 11 has one end forming a second end surface 111. When the sinker 10 is moved because of the lug 21 is driven in the driving path 22 of the cam 20, the first end surface 131 is horizontal while the second end surface 111 is inclined.

Refer to FIGS. 6 and 7 for another main element of the invention.

A yarn feeding plate 40 has one end forming an elongated mounting section 41 which has two slots 42 and a screw hole 43 for fastening to the machine deck.

The yarn feeding plate 40 has other end forming a polygonal yarn feeding section 44 which has a first yarn feeding port 45 and a second yarn feeding port 46 to allow knitting yarns to thread through for feeding. The yarn feeding section 44 has a dodging edge 48 on the bottom surface. The dodging edge 48 is an irregular and continuous curved surface designed according to the moving tracks of the sinker 10 in the driving path 22 of the cam 20 and aims to dodge the sinker 10. The dodging edge 48 has a slant surface 484 at the front edge to avoid hitting the sinker 10 when it is moved in the sinker drum 161 in an inclined manner.

Refer to FIGS. 4A and 4B for the invention in use, a pile yarn 17 is threaded through the first yarn feeding port 45, and a bottom yarn 18 is threaded through the second yarn feeding port 46. This paragraph aims to explain the release condition of a yarn lap 17a. First, the sinker 10 is moved in an inclined manner towards the circular center of the circular knitting machine (not shown in the drawings) until reaching a lower dead point (referring to FIG. 4A); meanwhile a needle 15 is lifted fully, and a tie yarn 19 is sunk to the root section of the needle 15; then the sinker 10 is moved rearwards in an inclined

manner until reaching an upper dead point (referring to FIG. 4B); the needle 15 is lowered to one half, and the yarn lap 17a escapes the nose section 12 of the sinker 10 and drops onto the second end surface 111 of the belly section 11, and is pulled downwards by the formed and coupled laps 14 in the front to become a release condition; the bottom yarn 18 also drops onto the second end surface 111 of the sinker 10; meanwhile the pile yarn 17 in the first yarn feeding port 45 is pulled downwards by the needle 15.

Referring to FIGS. 4C and 4D, the sinker 10 is moved slowly towards the circular center of the knitting machine (not shown in the drawings); the throat section 13 of the sinker 10 (also referring to FIG. 2) picks up the bottom yarn 18; the first end surface 131 of the throat section 131 compresses the formed laps 14 so that they do not float and hinder knitting operation.

Referring to FIG. 4E, the sinker 10 is moved slightly forwards, and the needle 15 is moved downwards to the lower dead point; meanwhile the needle 15 pulls the pile yarn 17 downwards and picks up the bottom yarn 18; then the tie yarn 19 is moved upwards from the root section of the needle 15 to close the latch 151 of the needle 15; the tie yarn 19

passes over the periphery of the needle 15 to wrap the pile yarn 17 and the bottom yarn 18 (referring to FIG. 4D); the nose section 12 holds the yarn lap 17a at a high horizontal spot to prevent the yarn lap 17a from slipping down. Thus complete the needle withdrawing and lap forming process.

Referring to FIGS. 4F and 4G, the sinker 10 is moved rearwards slightly (in a direction shown by the arrow); the needle 15 is lifted slightly to slightly loosen the yarn lap 17a; meanwhile the yarn lap 17a drops from the top end of the nose section 12 to a bracing point 121; finally the needle 15 is lifted, and the sinker 10 is moved forwards to lift the yarn lap 17a; the tie yarn 19 drops to the root section of the needle 15. Thus complete the knitting operation. The processes set forth may be repeatedly performed to knit a single-face counter-wrapped pile fabric.

The operation of the yarn feeding plate 40 and the sinker 10 is elaborated as follow:

Referring to FIG. 5, the dodging edge 48 on the distal end of the yarn feeding plate 40 is formed in a shape according to the movement track of the sinker 10 in the driving path 22 of the cam 20. The slant surface 484 on the front side of the dodge edge 48 is formed to avoid hitting the sinker 10 when it is moved

in an inclined manner in the sinker trough 161.

The dodging edge 48 is formed in an irregular and continuous curved surface as previously mentioned. It includes a first position 481, a second position 482 and a third position 483. The movement relationship of the yarn feeding plate 40 and the sinker 10 is elaborated as follow:

First, the sinker 10 is mounted on a sinker drum 16 which is located on an inner annular ring of the circular knitting machine, and is formed in the shape of a conical and shallow tray. The sinker drum 16 has sinker troughs 161 formed on the perimeter in an equally spaced fashion to house the sinkers 10. The sinker drum 16 is rotated at high speed during knitting operation to drive the sinker 10 to turn at high speed.

In addition, while the sinker 10 is turning, it also is driven by the driving path 22 of the cam 20 and moved to and fro reciprocally. The movement track of the sinker 10 is determined by the driving path 22 as shown in FIG. 8, which illustrates the track according to time sequence. The irregular and continuous curved surface of the dodging edge 48 of the yarn feeding plate 40 is determined by the movement track of the sinker 10. As the sinker 10 is mounted in an inclined manner and turned continuously and moved

reciprocally, it is pone to interfere with the yarn feeding plate 40. The dodging edge 48 of the yarn feeding plate 40 aims to match the movement track of the sinker 10 to prevent such interference.

Refer to FIGS. 9A through 9C, and FIGS. 7 and 8 for the sinker 10 in movement conditions. Referring to FIG. 9A, the sinker 10 is located at the front most end (i.e. first point 1 in the time sequence chart shown in FIG. 8). When the sinker 10 is driven and moved along the driving path 22 to the front most position, the yarn feeding plate 40 has a matching concave surface of the first position 481.

Referring to FIG. 9B, the sinker 10 is driven by the driving path 22 and moved backwards (in the direction shown by the arrow, at second point 2 in the time sequence chart in FIG. 8) until reaching to the rear most position; the sinker 10 is at the lowest point. The yarn feeding plate 40 is at the second position 482. The irregular and continuous curved surface of the dodging edge 48 has a track same as the one from the first point 1 to the second point 2 in the time sequence chart. Therefore it can avoid hitting the sinker 10 during the to and fro movement and prevent interference.

Referring to FIG. 9C, the driving path 22 drives

the sinker 10 to move forwards in an inclined manner (also indicated by the arrow direction); the third position 483 of the dodging edge 48 can dodge the sinker 10, and the irregular and continuous curved surface of the dodging edge 48 has a track same as the one moving to the third point 3 in the time sequence chart. Therefore it can avoid hitting the sinker 10 during the to and fro movement and prevent interference. Thus the shape of the dodging edge 48 of the yarn feeding plate 40 is formed according to the movement track of the sinker 10. In addition, the entire irregular and continuous curved surface of the dodging edge 48 also forms an inclined surface 484 at the distal end to match the slant installation of the sinker 10 on the sinker drum 16. Thereby the continuous rotation of the sinker 10 that also is moved in an inclined manner in the sinker trough 161 does not hit the inclined surface 484 at the front end of the dodging edge 48.

While the preferred embodiment of the invention has been set forth for the purpose of disclosure, modifications of the disclosed embodiment of the invention as well as other embodiments thereof may occur to those skilled in the art. Accordingly, the appended claims are tended to cover all embodiments which do not depart from the spirit and scope of

the invention.